Rice University
Civil and Environmental Engineering

CEVE 420/520 – ENVIRONMENTAL REMEDIATION AND RESTORATION

FALL 2013 Syllabus

Course objective

The objective of this class is to provide you with the knowledge of chemicals, technologies, and institutional considerations that you need to select an appropriate method for cleaning up contaminated soil, groundwater, sediment, and surface water.

Textbooks

There is no textbook for this class, but I will give you technical papers, book extracts, and reading assignments from books that I put on reserve in the library throughout the semester.

Grading

Exams (2)	40%
Homework	20%
Report	20%
Final (not comprehensive)	20%

Exams

Two closed-book exams will be given in class. The first exam is tentatively scheduled for October 7, and the second is tentatively scheduled for November 11. Both exams will be mostly qualitative with short answers to test your knowledge of specific issues and your understanding of key concepts. There will also be some brief quantitative exam questions to make sure that you know how to apply some of the principles taught.

The final exam will be not be comprehensive and similar to the first two exams.

Homework

Homework assignments will generally be due 1 to 2 weeks after distribution. Assignments and solutions will be posted on Owlspace. Grades on late homework assignments will be reduced by 10 percent of the possible homework grade for each day or part of day that they are late. Extensions can be given *with prior arrangement*.

Report

Each student will prepare a design report on a key topic covered in the class. The report will consist of a conceptual design of a site remediation project. Key elements of the report will include:

- A background section explaining the issue and technical approach;
- How cleanup levels were established;
- A description of the technology selection process;
- A detailed description of the selected technology;
- A preliminary conceptual design, in the form of text and rough drawings, that illustrate the major design components;
- Calculations to support estimates of materials, labor, and capital needs as well as technical performance;
- A preliminary cost estimate and schedule.

Field trip to Industrial Site

We will take a field trip to an industrial site to see monitoring wells and see active groundwater extraction systems, time permitting. The trip is tentatively scheduled for late October or after the first cold front passes through, but the date is subject to change based on student commitments, weather, and plant activities.

Instructor and Office Hours

Phillip C. de Blanc, Ph.D., P.E.
Lecturer in Civil and Environmental Engineering
262 Mech Lab
Phone: 713-348-4725
Mobile: 281-635-6069 (Emergencies only please!)
Email: pcdeblanc@rice.edu

Office hours 10:00 to 11 a.m. MWF and by appointment.

I check email regularly, and you are encouraged to communicate by email whenever possible. I will usually respond within a few hours, but never more than 24 hours later (except on weekends and holidays).

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1. Introduction
    a. Why clean up the environment?
    b. Sources and Extent of Chemical Contamination in the U.S. and World
    c. Types of sites
    d. Types of Media Affected with examples
    e. Classes of chemical contaminants
    f. Physical nature of contaminants (dissolved, NAPLs, etc.)
2. Site Investigation
    a. Objectives – ID nature, magnitude, and extent of impacts
    b. Conceptual model
    c. Preliminary assessment
    d. Field investigation techniques
    e. Field testing techniques (slug tests, pumping tests, tracer tests)
    f. Laboratory analyses
    g. Assessing extent of impacted media (interpolation techniques, etc.)
3. Risk Assessment
    a. Fundamentals – dose, pathways
    b. Carcinogenic and non-carcinogenic risk considerations
    c. Forward calculations – determining risk from a site.
    d. Backward calculations – calculating cleanup levels
    e. Statistical methods for cleanup
4. Chemical and Physical Properties Affecting Remediation Technologies
    a. Media Characteristics
    b. Chemical Characteristics
    c. Institutional
5. Remediation objectives and classification of technologies
    a. Remediation Objectives
    b. Classification of Remediation Technologies
6. Technologies for Soil Remediation
7. Technologies for Groundwater Remediation
    a. Groundwater extraction
    b. Ex-situ groundwater treatment
    c. In-situ groundwater treatment
    d. Containment
8. Selection of remedial alternatives
    a. Sources of information on remediation technologies
    b. Factors to consider
    c. Presumptive remedies
    d. Technology evaluation
    e. Assembling technologies into complete alternatives
    f. Criteria for evaluation of alternatives
9. Remediation Design Elements
    a. Treatability testing
    b. Supplementary investigations
    c. Design

   d. Use of models
   e. Cost Optimization
   f. Long-term monitoring
   g. Sustainability
10. Surface Water and Sediment Restoration

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Day	Date	Week	Number	Subject
Mon	26-Aug	1	1	First Day of Class Introduction
Wed	28-Aug	1	2	Site Investigations
Mon	**2-Sep**	**2**		**Labor Day - No Class**
Wed	4-Sep	2	3	Site Investigations Guest Lecture – Site Investigation Field Techniques
Mon	9-Sep	3	4	Risk Assessment
Wed	11-Sep	3	5	Chemical, Physical Properties
Mon	16-Sep	4	6	Soil remediation
Wed	18-Sep	4	7	Classes of remediation technologies Guest Lecture – Risk Assessment
Mon	23-Sep	5	8	Soil remediation technologies
Wed	25-Sep	5	9	Soil remediation technologies
Mon	30-Sep	6	10	Soil remediation technologies
Wed	2-Oct	6	11	Focus: soil vapor extraction Guest Lecture – SVE system design
Mon	7-Oct	7	12	Exam No. 1
Wed	9-Oct	7	13	Groundwater remediation
Mon	**14-Oct**	**8**		**Mid-Term Recess No Class**
Wed	16-Oct	8	14	Groundwater remediation technologies
Mon	21-Oct	9	15	Groundwater remediation technologies

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Day	Date	Week	Number	Subject
Wed	23-Oct	9	16	Groundwater remediation technologies
Mon	28-Oct	10	17	Focus: engineered bioremediation Guest Lecture – In-Situ Bio Design
Wed	30-Oct	10	18	Selection of remedial technologies
Mon	4-Nov	11	19	Remediation design elements
Wed	**6-Nov**	**11**	**20**	**Field Trip**
Mon	11-Nov	12	21	Exam No. 2
Wed	13-Nov	12	22	Surface water resources (Bedient)
Mon	18-Nov	13	23	Surface Water/Sediments (Bedient)
Wed	20-Nov	13	24	River restoration (Bedient)
Mon	25-Nov	14	25	River restoration (Bedient)
Wed	27-Nov	14	26	Low impact development (Bedient)
Mon	2-Dec	15	27	Low impact development (Bedient)
Wed	4-Dec	15	28	Last day of class (open)
??	11-Dec to 18-Dec			Exam 3
Wed	18-Dec			Reports Due